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**THE EFFECTS OF ROCKET MOTOR OPERATING CONDITIONS ON EXHAUST  
PLUME SOOT CONCENTRATIONS**

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**OBJECTIVE:** To obtain the optical properties, physical size, and mass loading of soot present in a liquid-fuel/gaseous oxygen rocket engine operating at fuel rich conditions and evaluate the effects of selected additives on those properties.

**SUMMARY:** The past year has involved the operation of a kerosene/oxygen rocket engine with uniform exhaust soot loading under fuel-rich conditions both with and without additives present in the fuel. A multiple-wavelength extinction technique was used to obtain the optical properties of the soot present in the exhaust. An IR camera and IR spectrometer were also used to determine plume signature characteristics both spatially and spectrally. Using these experimental techniques, the effects of various fuel additives on the plume signature and soot mass loading was observed and characterized.

## **OPERATIONAL REQUIREMENTS FOR LIQUID-FUELED PULSE DETONATION ENGINES**

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**OBJECTIVE:** To determine the atomization and mixing requirements for a liquid-fuel/air pulse detonation engine (PDE) combustor operating at ambient and simulated flight conditions.

**SUMMARY:** A pulse detonation combustor which operates on JP-10 and gaseous oxygen has been chosen as the predetonator (ignition source) for a larger JP-10/air PDE system. This geometry resulted from research performed over the previous year which varied fuel injectors and geometries to determine a particular configuration which resulted in consistent detonations at desired frequencies. This year has involved the design and construction of the two air-breathing combustors the facility operation and control hardware required for each. The combustor which operates at ambient conditions is currently being operated, and the simulated flight condition combustor will be on-line before the end of March, 2000.